

WASTE STREAM	7A109	Decommissioning Waste from Reactors ILW
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SITE AWE Aldermaston

SITE OWNER Ministry of Defence

WASTE CUSTODIAN AWE plc

WASTE TYPE ILW

Is the waste subject to Scottish Policy: No

WASTE VOLUMES

		Reported
Stocks:	At 1.4.2022.....	3.0 m ³
Future arisings -	1.4.2022 - 31.3.2045.....	0 m ³
	1.4.2046 - 31.3.2047.....	4.0 m ³
	1.4.2048 - 31.3.2080.....	0 m ³
Total future arisings:		4.0 m ³
Total waste volume:		7.0 m ³

Comment on volumes: The decommissioning of the Viper and Herald reactors will not be a continuous process. Future arisings are estimated based on the current decommissioning plans for facilities on site, which is subject to change over time. 3m³ box of reactor components deducted from the stock, as now LLW (transferred to 7A116). The total volume of arisings will depend on the longevity of the AWE site. Estimates have been made based on a site closure date of 2080.

Uncertainty factors on volumes: Stock (upper): x 2.0 Arisings (upper) x 3.0
 Stock (lower): x 1.0 Arisings (lower) x 0.5

WASTE SOURCE Decommissioning waste from a research reactor facility and associated buildings including the removal of reactor elements and other items stored in the Used Fuel Store Tank. No fuel is present in this waste stream.

PHYSICAL CHARACTERISTICS

General description: Components from the reactor core. Aluminium plate and pipe, beryllium billets, stainless steel and stainless steel clad cadmium. The reactor core box (4 x 2 x 1m) is difficult to handle and is likely to require cutting up. Contents reviewed and updated for 2022 UKRWI.

Physical components (%wt): Metal (99.31%) and resin (0.69%)

Sealed sources: The waste does not contain sealed sources.

Bulk density (t/m³): 3.94

Comment on density: Based upon a revised 'in-stock' waste figure for 2022.

CHEMICAL COMPOSITION

General description and components (%wt): Metal (99.31%) and resin (0.69%)

Chemical state: Neutral

Chemical form of radionuclides: H-3: Not present in this waste stream
 C-14: Not present in this waste stream
 Cl-36: Not present in this waste stream
 Se-79: Not present in this waste stream
 Tc-99: Not present in this waste stream
 I-129: Not present in this waste stream
 Ra: Present in this waste stream In the form of oxide.
 Th: Present in this waste stream In the form of oxide.
 U: Not present in this waste stream
 Np: Not present in this waste stream
 Pu: Not present in this waste stream

Metals and alloys (%wt): This waste is 99.31% bulk metal.

WASTE STREAM

7A109

Decommissioning Waste from Reactors ILW

	(%wt)	Type(s) / Grade(s) with proportions	% of total C14 activity
Stainless steel.....	14.5		
Other ferrous metals.....	0		
Iron.....	0		
Aluminium.....	78.3		
Beryllium.....	5.4		
Cobalt.....	0		
Copper.....	0		
Lead.....	0		
Magnox/Magnesium.....	0		
Nickel.....	0		
Titanium.....	0		
Uranium.....	0		
Zinc.....	0		
Zircaloy/Zirconium.....	0		
Other metals.....	1.1	Cadmium (1.13% wt)	
Organics (%wt):	-		
	(%wt)	Type(s) and comment	% of total C14 activity
Total cellulose.....	0		
Paper, cotton.....	0		
Wood.....	0		
Halogenated plastics	0		
Total non-halogenated plastics.....	0		
Condensation polymers.....	0		
Others.....	0		
Organic ion exchange materials....	0		
Total rubber.....	0		
Halogenated rubber	0		
Non-halogenated rubber.....	0		
Hydrocarbons.....	0		
Oil or grease	0		
Fuel.....	0		
Asphalt/Tarmac (cont.coal tar)...	0		
Asphalt/Tarmac (no coal tar)....	0		
Bitumen.....	0		
Others.....	0		
Other organics.....	0		
Other materials (%wt):	-		

WASTE STREAM

7A109

Decommissioning Waste from Reactors ILW

	(%wt)	Type(s) and comment	% of total C14 activity
Inorganic ion exchange materials..	0.69		
Inorganic sludges and flocs.....	0		
Soil.....	0		
Brick/Stone/Rubble.....	0		
Cementitious material.....	0		
Sand.....	0		
Glass/Ceramics.....	0		
Graphite.....	0		
Desiccants/Catalysts.....	0		
Asbestos.....	0		
Non/low friable.....	0		
Moderately friable.....	0		
Highly friable.....	0		
Free aqueous liquids.....	0		
Free non-aqueous liquids.....	0		
Powder/Ash.....	0		

Inorganic anions (%wt): -

	(%wt)	Type(s) and comment
Fluoride.....	0	
Chloride.....	0	
Iodide.....	0	
Cyanide.....	0	
Carbonate.....	0	
Nitrate.....	0	
Nitrite.....	0	
Phosphate.....	0	
Sulphate.....	0	
Sulphide.....	0	

Materials of interest for waste acceptance criteria: This waste contains beryllium (5.37% wt) and cadmium (1.13% wt).

	(%wt)	Type(s) and comment
Combustible metals.....	0	
Low flash point liquids.....	0	
Explosive materials.....	0	
Phosphorus.....	0	
Hydrides.....	0	
Biological etc. materials.....	0	
Biodegradable materials.....	0	
Putrescible wastes.....	0	
Non-putrescible wastes.....	0	

WASTE STREAM	7A109	Decommissioning Waste from Reactors ILW
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Corrosive materials.....	0
Pyrophoric materials.....	0
Generating toxic gases.....	0
Reacting with water.....	0
Higher activity particles.....	0
Soluble solids as bulk chemical compounds.....	0

Hazardous substances / non hazardous pollutants: This waste contains beryllium (5.37% wt) and cadmium (1.13% wt).

	(%wt)	Type(s) and comment
Acrylamide.....	0	
Benzene.....	NE	
Chlorinated solvents.....	0	
Formaldehyde.....	0	
Organometallics.....	0	
Phenol.....	NE	
Styrene.....	0	
Tri-butyl phosphate.....	NE	
Other organophosphates.....	0	
Vinyl chloride.....	0	
Arsenic.....	NE	
Barium.....	0	
Boron.....	NE	
Boron (in Boral).....	NE	
Boron (non-Boral).....	0	
Cadmium.....	P	
Caesium.....	0	
Selenium.....	NE	
Chromium.....	NE	
Molybdenum.....	NE	
Thallium.....	0	
Tin.....	NE	
Vanadium.....	NE	
Mercury compounds.....	0	
Others.....	NE	
Electronic Electrical Equipment (EEE)		
EEE Type 1.....	0	
EEE Type 2.....	0	
EEE Type 3.....	0	
EEE Type 4.....	0	
EEE Type 5.....	0	

WASTE STREAM	7A109	Decommissioning Waste from Reactors ILW
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Complexing agents (%wt): No

	(%wt)	Type(s) and comment
EDTA.....	0	
DPTA.....	0	
NTA.....	0	
Polycarboxylic acids.....	0	
Other organic complexants.....	0	No complexing agents are present in the waste stream.
Total complexing agents.....	0	

Potential for the waste to contain discrete items: Yes.

PACKAGING AND CONDITIONING

Conditioning method: A conditioning and packaging regime has yet to be determined, with development work continuing. The waste will be stored in 3m3 boxes, until a disposal route has been established.

Plant Name: -
 Location: Unknown
 Plant startup date: Unknown
 Total capacity (m³/y incoming waste): -
 Target start date for packaging this stream: -
 Throughput for this stream (m³/y incoming waste): -
 Other information: -

Likely container type:	Container	Waste packaged (%vol)	Waste loading (m³)	Payload (m³)	Number of packages
	3m³ box (round corners)	100.0	~5.4	~2.7	2

Likely container type comment: A conditioning factor of 0.5 has been assumed.

Range in container waste volume: -

Other information on containers: -

Likely conditioning matrix: Not Specified

Other information: -

Conditioned density (t/m³): ~2.0

Conditioned density comment: The conditioned density is an estimate which may be subject to change.

Other information on conditioning: -

Opportunities for alternative disposal routing: Not yet determined

WASTE STREAM**7A109****Decommissioning Waste from Reactors ILW**

Baseline Management Route	Opportunity Management Route	Stream volume (%)	Estimated Date that Opportunity will be realised	Opportunity Confidence	Comment
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RADIOACTIVITY

Source:	Principally neutron activation of solids in solid form. The other source is experimental samples (e.g. Ra-226 and Th-232).
Uncertainty:	Specific activities owing to future arisings are based on the current in-stock waste activities, which may be inaccurate if the decommissioning window is delayed. In stock gross alpha and beta activities/associated nuclides are thought to be accurate.
Definition of total alpha and total beta/gamma:	Where totals are shown on the table of radionuclide activities they are the sums of the listed alpha or beta/gamma emitting radionuclides plus 'other alpha' or 'other beta/gamma'.
Measurement of radioactivities:	The activity was derived from historical data using High Resolution Gamma-ray Spectroscopy assay and computer modelling software.
Other information:	-

WASTE STREAM 7A109 Decommissioning Waste from Reactors ILW

Nuclide	Mean radioactivity, TBq/m ³				Nuclide	Mean radioactivity, TBq/m ³			
	Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code		Waste at 1.4.2022	Bands and Code	Future arisings	Bands and Code
H 3				5	Gd 153				
Be 10				5	Ho 163				
C 14				5	Ho 166m				
Na 22					Tm 170				
Al 26					Tm 171				
Cl 36				5	Lu 174				
Ar 39					Lu 176				
Ar 42					Hf 178n				
K 40					Hf 182				
Ca 41				5	Pt 193				
Mn 53					Tl 204				
Mn 54				5	Pb 205				
Fe 55				5	Pb 210				
Co 60	2.82E-01	BB 2	~2.82E-01	CC 2	Bi 208				
Ni 59				5	Bi 210m				
Ni 63				5	Po 210				
Zn 65				5	Ra 223				
Se 79					Ra 225				
Kr 81					Ra 226	6.88E-05	BB 2		5
Kr 85					Ra 228				
Rb 87					Ac 227				
Sr 90					Th 227				
Zr 93				5	Th 228				
Nb 91					Th 229				
Nb 92					Th 230				
Nb 93m				5	Th 232	6.89E-05	BB 2		5
Nb 94				5	Th 234				
Mo 93				5	Pa 231				
Tc 97					Pa 233				
Tc 99					U 232				
Ru 106					U 233				
Pd 107					U 234				
Ag 108m				5	U 235				
Ag 110m					U 236				
Cd 109					U 238				
Cd 113m					Np 237				
Sn 119m					Pu 236				
Sn 121m					Pu 238				
Sn 123					Pu 239				
Sn 126					Pu 240				
Sb 125					Pu 241				
Sb 126					Pu 242				
Te 125m					Am 241				
Te 127m					Am 242m				
I 129					Am 243				
Cs 134					Cm 242				
Cs 135					Cm 243				
Cs 137					Cm 244				
Ba 133					Cm 245				
La 137					Cm 246				
La 138					Cm 248				
Ce 144					Cf 249				
Pm 145					Cf 250				
Pm 147					Cf 251				
Sm 147					Cf 252				
Sm 151					Other a				
Eu 152					Other b/g				
Eu 154					Total a	1.38E-04	BB 2	0	5
Eu 155					Total b/g	2.82E-01	BB 2	~2.82E-01	CC 2

Bands (Upper and Lower)

- A a factor of 1.5
- B a factor of 3
- C a factor of 10
- D a factor of 100
- E a factor of 1000

Note: Bands quantify uncertainty in mean radioactivity.

Code

- 1 Measured activity
- 2 Derived activity (best estimate)
- 3 Derived activity (upper limit)
- 4 Not present
- 5 Present but not significant
- 6 Likely to be present but not assessed
- 7 Present in significant quantities but not determined
- 8 Not expected to be present in significant quantity